476364-0-1-TM

DATATAPE®

# 12-471
# TAPE LOCK SERVO

## TECHNICAL MANUAL

BELL & HOWELL
DATATAPE DIVISION
300 SIERRA MADRE VILLA, PASADENA, CA 91109

# LIST OF EFFECTIVE PAGES

Title Page ..... 476364-0-1-TM
List of Effective Pages ..... 12-78
Pages i and ii ..... 12-78
Pages 1-1 through 1-3 ..... 12-78
Page 1-4 Blank
Page 2-1 ..... 12-78
Page 2-2 Blank
Page 3-1 ..... 12-78
Page 3-2 Blank
Pages 4-1 through 4-4 ..... 12-78
Pages 5-1 and 5-2 ..... 12-78
Pages 6-1 through 6-7 ..... 12-78
Page 6-8 Blank
Page 7-1 ..... 12-78
Page 7-2 Blank
Page 7-3 ..... 12-78
Page 7-4 Blank

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| SECTION I. | GENERAL DESCRIPTION | |
| | 1-1. General | 1-1 |
| | 1-3. Equipment Description | 1-1 |
| | 1-6. Performance Characteristics | 1-1 |
| SECTION II. | INSTALLATION | |
| | 2-1. General | 2-1 |
| SECTION III. | OPERATION | |
| | 3-1. General | 3-1 |
| SECTION IV. | THEORY OF OPERATION | |
| | 4-1. General | 4-1 |
| | 4-5. Circuit Descriptions | 4-3 |
| SECTION V. | CALIBRATION AND MAINTENANCE | |
| | 5-1. General | 5-1 |
| | 5-3. Preventive Maintenance | 5-1 |
| | 5-5. Troubleshooting and Corrective Maintenance | 5-1 |
| | 5-11. Repair | 5-2 |
| | 5-14. Field Repair Service | 5-2 |
| | 5-16. Factory Repair Service | 5-2 |
| SECTION VI. | PARTS LIST | |
| | 6-1. General | 6-1 |
| | 6-3. Manufacturer's Codes | 6-1 |
| | 6-5. Ordering Replacement Parts | 6-1 |
| SECTION VII. | DRAWINGS AND SCHEMATICS | |
| | 7-1. General | 7-1 |

## LIST OF ILLUSTRATIONS


| Figure | Title | Page |
|---|---|---|
| 1-1 | Tape Lock Servo | 1-3 |
| 4-1 | Block Diagram, Tape Lock Servo Record Circuit | 4-1 |
| 4-2 | Block Diagram, Reproduce Tape Lock Servo | 4-2 |
| 4-3 | Bandpass Action of Combined High-Pass and Low-Pass Filters | 4-3 |
| 6-1 | Tape Lock Servo Printed Wiring Board | 6-2 |
| 7-1 | Schematic, Tape Lock Servo | 7-1 |


## LIST OF TABLES


| Table | Title | Page |
|---|---|---|
| 1-1 | Typical Performance Characteristics of the Tape Lock Servo | 1-2 |
| 6-1 | Parts List for the 12-471 Tape Lock Servo | 6-3 |

# SECTION I

# GENERAL DESCRIPTION

## 1-1. GENERAL.

1-2. This manual describes the 12-471 Tape Lock Servo and its function within the capstan speed control system. In the TACH position of the TACH/TAPE switch (mounted on the front panel), the capstan motor forms part of the closed loop servo system. In this system, the speed of the motor, as indicated by the tachometer, is compared to a crystal controlled reference frequency. In the TAPE position, the speed of the tape, as indicated by a prerecorded signal on any channel, is compared to the reference frequency for speed control. In this latter position, the speed of the tape is maintained to within $\pm$0.015 percent of the original speed at which the signal was recorded.

## 1-3. EQUIPMENT DESCRIPTION.

1-4. The 12-471 Tape Lock Servo is pictured in figure 1-1. It is constructed on a printed circuit board similar to the record and reproduce circuit cards of this system. The dimensions are 4-19/32 inches high by 7-3/8 inches deep by 29/32 inches wide. The components of the unit are mounted on one side of a double sided printed circuit board. A shield, to minimize RF interference and coupling between amplifiers, is mounted on the back side of the board. Operating power for the record unit is furnished when the amplifier is installed in the amplifier case.

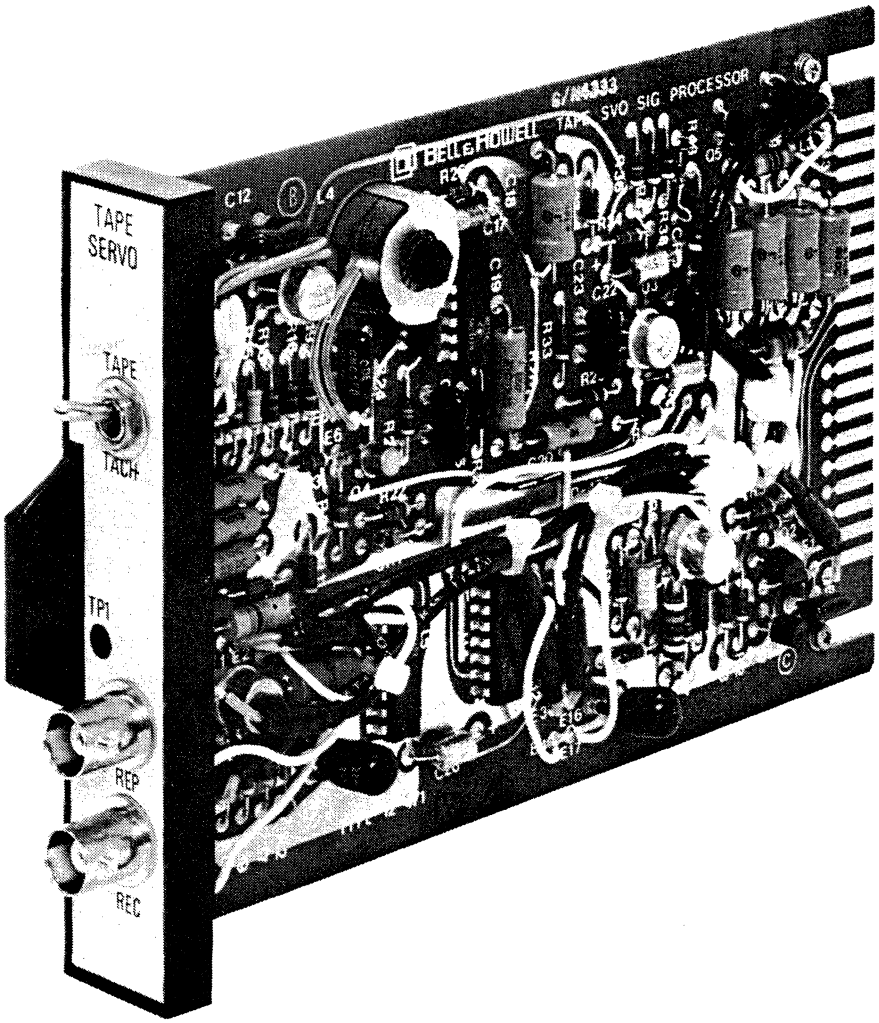
1-5. The front panel contains two BNC connectors for the input and output signals and a TACH/TAPE switch. All test points and all the circuit components are accessible when the amplifier is mounted on an extender card.

## 1-6. PERFORMANCE CHARACTERISTICS.

1-7. Typical performance characteristics for the 12-471 Tape Lock Servo are given in table 1-1.

| ITEM | CHARACTERISTIC |
|---|---|
| Reproduce input level | 1 Vrms, from reproduce amplifier. |
| Reproduce input impedance | 510 ohms. |
| Record output level | 1 Vrms, to record amplifier. |
| Record output impedance | 20 ohms. |
| Bandpass | 1 kHz to 100 kHz, upper end electrically switchable by the speed control lines. |
| Power | +15 and -15 Vdc filtered after being received from the regulators, +5 Vdc from the transport power supply. |

Table 1-1. Typical Performance Characteristics of the Tape Lock Servo




KH3608-10

Figure 1-1. Tape Lock Servo

# SECTION II

# INSTALLATION

2-1. GENERAL.

2-2. When the 4020 system is installed on an initial installation, the 12-471 Tape Lock Servo Assembly will be installed at the completion of the installation procedures as described in Section II of the system manual.

2-3. When replacing the tape lock servo, follow the installation procedures in Section II of the system manual, and then perform the operational checkout listed in Section III of the system manual.

# SECTION III

# OPERATION

## 3-1. GENERAL.

3-2. The 12-471 Tape Lock Servo is fully operational when power is turned on and once the installation procedures outlined in Section II of the system manual have been completed. Refer to Section III of the system manual for the operational procedures of the 12-471 Tape Lock Servo Assembly.

# SECTION IV

# THEORY OF OPERATION

## 4-1. GENERAL.

4-2. The tape lock servo assembly consists of two separate sections, serving the functions of recording tape speed control signals and reproducing tape speed control signals. Figure 4-1 is a block diagram of the record circuits. Figure 4-2 is a block diagram of the reproduce circuits.

4-3. To record a reference signal on tape (figure 4-1), a reference signal from the control logic record amplifier reference gates is applied to transistor Q1, enabled by transistor Q2 ($\overline{REC}$), buffered by transistor Q3, and applied via a coaxial cable to the desired direct record amplifier to be recorded on tape.

4-4. To reproduce the reference signal (figure 4-2), a coaxial cable is used to connect the output of the direct reproduce amplifier to the tape lock servo. This signal is applied to six speed switchable low-pass filters via a low-pass filter and a high-pass filter. This signal is amplified and applied to a Schmitt trigger which produces a square wave to control the speed of the capstan. This amplified signal is level detected and used to trigger a one-shot which is enabled by the TACH/TAPE switch being in the TAPE position. The output of the one-shot enabled by RUN MEM (transport in run mode) and REC MEM (transport not in record mode) will switch the capstan servo to tape mode and via lamp driver Q6 will cause the TAPE SERVO indicator to illuminate.

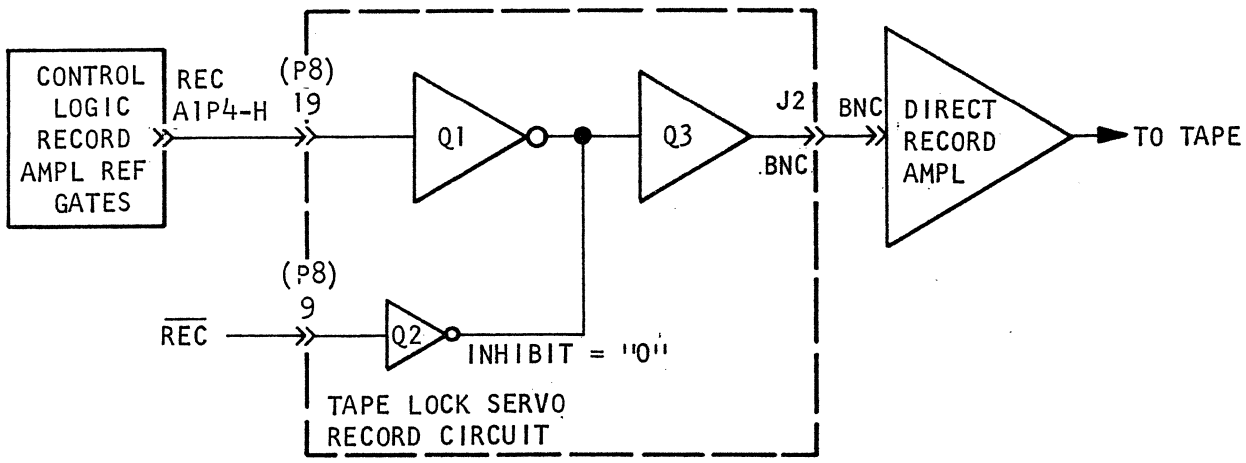



Figure 4-1. Block Diagram, Tape Lock Servo Record Circuit

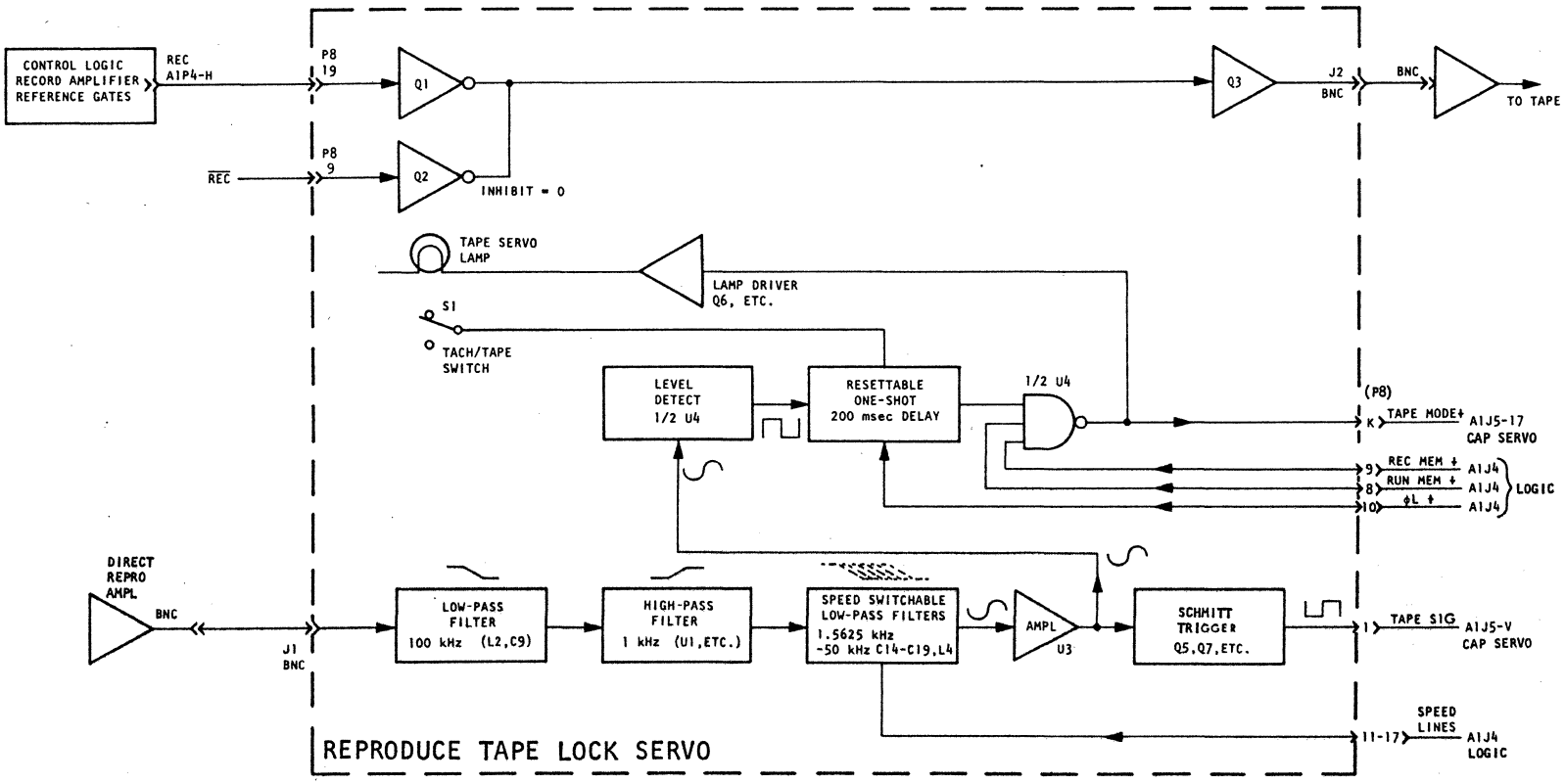



Figure 4-2. Block Diagram, Reproduce Tape Lock Servo

4-5. CIRCUIT DESCRIPTIONS.

4-6. RECORD CIRCUIT. The record circuit (figure 7-1) consists of three transistors and their associated components. Transistor Q1 performs a switching function on the REC AMPL REF signal as received from the speed gates in the control logic. The signal is then applied to Q3, an emitter-follower, and to the output BNC connector J2. The amplitude of this square wave signal is 2 volts peak-to-peak and may be cabled to any direct record amplifier for recording on the servo track.

4-7. The function of transistor Q2 is to clamp the collector of Q1 to ground (inhibit) in any operating mode except RECORD.

4-8. REPRODUCE CIRCUIT. The reproduce circuit consists of two integrated circuit amplifiers, a TAPE MODE decision making circuit, and a bandpass filter which has an electrically switchable upper frequency stop-band. The bandpass filter improves the signal-to-noise ratio of the reproduce signal, thus improving the quality and accuracy of the tape speed control.

4-9. Refer to figure 7-1. The reproduce tape signal is received at the front panel BNC connector J1 and is coupled through the low-pass filter (L2 and C9), C10, C11, and R17 to pin 3 of operational amplifier U1. The signal is then applied to L4 and the RC components which form the electrically switchable low-pass filters. According to the selected speed of 15/16 ips to 30 ips, one of the open collector integrated circuits will switch in the appropriate RC components. At 60 ips, all the open collector integrated circuits will be inactive, however, Q4 will conduct, since its base is controlled by the 60 ips speed line. Thus, the inductor L4 is bypassed and the signal for 60 ips is passed directly to U3-3. Figure 4-3 shows the frequency response of the bandpass action of the combined high-pass filter and low-pass filter circuits.

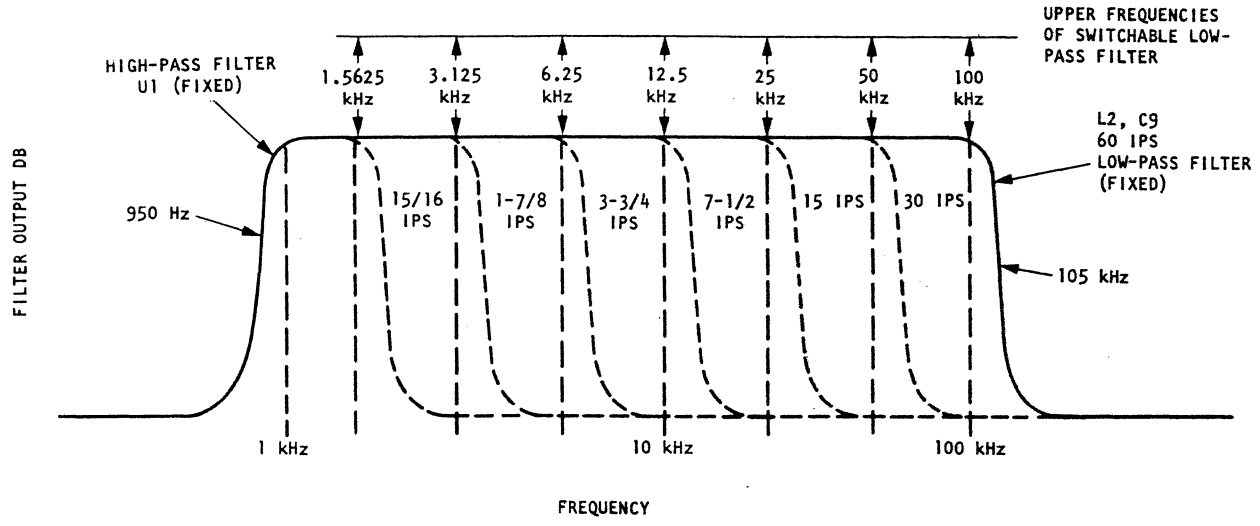



Figure 4-3. Bandpass Action of Combined High-Pass and Low-Pass Filters

4-10. Integrated circuit, U3, amplifies the signal and applies it to the Schmitt trigger circuit of Q5 and Q7. The output of Q7 is a square wave the same frequency as that reproduced from the channel containing the signal recorded for speed control. This TAPE signal is routed to the TACH/TAPE switch logic circuit on the capstan servo logic board.

4-11. The function of U4 and U5 is to generate a TAPE MODE command when the required conditions for the tape mode are met. These conditions are: (1) a tape signal of sufficient amplitude; (2) the capstan is in TACH phase lock; (3) the TACH/TAPE switch is in the TAPE position; (4) the system is in RUN; and (5) a RECORD command is not given. The sine wave of the reproduce signal frequency is also fed to the input of the level detector U4-9. An inverted square wave is generated for all signals -10 dB below normal and above. This square wave is connected to the inverting OR gate of U5. When pins 1 and 2 are low, the output of the inverting OR gate is high, enabling the four-input AND gate of U5 provided the TACH/TAPE switch is in the TAPE position and that U5-3 and U5-4 are high (in phase lock). The flip-flop within U5 is continually set by the high output of the AND gate and when U5-1 and U5-2 are low and U5-3, U5-4, and U5-5 are high. This provides a steady "1" on U5-8 provided the flip-flop does not reset. The time constant of resistor R37 and capacitor C27 provides a 200-millisecond time out of the resettable one-shot multivibrator. As long as the period of the reproduce speed frequency is less than 200 milliseconds and arrives at constant intervals (no dropouts or loss of signal), the flip-flop will remain set. A low signal on U5-3 or U5-4 will reset the flip-flop. The second half of U4 is a NAND gate and for its output to be a zero (TAPE MODE) all its inputs on pins 1, 2, 4, and 5 must be high. This means that the logic circuits of U4 and U5 must have an adequate tape signal, be in the RUN mode, and not in RECORD. The TAPE mode line being low means that "tape" has been commanded by the TACH/TAPE switch S1, on the front panel, and that the capstan has achieved phase lock on the tachometer signal. In the event any of the required conditions to maintain the TAPE MODE fail, the transport will automatically transfer to the TACH MODE.

4-12. The other output from the NAND gate U4-6 is fed to the base of transistor Q6, causing it to saturate when the TAPE MODE signal is a logical "0". The conduction of Q6 illuminates the TAPE LOCK indicator and, when the PHASE LOCK indicator on the control panel illuminates, the transport is in TAPE MODE PHASE LOCK.

# SECTION V

## CALIBRATION AND MAINTENANCE

5-1. GENERAL.

5-2. Maintenance for the 12-471 Tape Lock Servo consists of preventive maintenance, and troubleshooting and corrective maintenance.

5-3. PREVENTIVE MAINTENANCE.

5-4. Preventive maintenance consists of general cleaning and periodic inspection. Accumulation of dust, dirt, grit, and/or grease on the circuit boards is harmful and should be guarded against by periodic inspection and cleaning. Every three months, inspect the amplifier card for signs of deterioration, loose connections, insecurity of mounting, and foreign matter. The period of cleaning depends on the particular operating environment and should be determined by inspection. As necessary, clean the circuit board with a soft brush, low air pressure, or suitable solvent, being careful not to damage the printed circuitry.

5-5. TROUBLESHOOTING AND CORRECTIVE MAINTENANCE.

5-6. Before attempting the repair of a unit suspected of a malfunction, verify that the symptom is not caused by the malfunction of associated equipment such as the record or reproduce amplifier, the power supply, the mother board assembly, or intercabling errors. This can be done by substituting a known good amplifier for the suspected one, or by making continuity checks from unit to unit. If such a check eliminates the associated equipment as a source of trouble, check circuit components of the unit using the schematic diagram in Section VII and the circuit descriptions in Section IV of this manual.

5-7. Once the existence of a defective unit has been established, check it for obvious signs of damaged components, such as burned resistors, or incorrect seating of components. The next step is to check that the proper supply voltage is reaching the unit. If the supply voltage is correct, the faulty stage within the unit can be located by tracing the signals from stage to stage.

5-8. TRACING SIGNALS. To trace signals of the record circuit, mount the unit on an extender card and place the system in RECORD at a slow speed. Isolation of the defective component is a matter of tracing the signal back to the signal input stage of transistor Q1. The normal waveform at J2 and pin 19 will be a square wave of a frequency associated with the tape speed.

5-9. Once the defective stage has been located, the defective component in that stage can be determined by reference to the schematic diagram, and by making continuity, voltage, and/or resistance measurements about the suspected components. The prime exception to this is open coupling capacitors, which should be checked by substitution, or by adding a test capacitor in parallel.

5-10. To trace signals of the reproduce circuit, place the system in RUN at a low speed with the TACH/TAPE switch in the TAPE position. Check the output of the reproduce amplifier and ensure its level is correct at J1. Trace the signal through the circuit until the defective stage is isolated. Check each open collector integrated circuit and the associated filters by stepping through each of the tape speeds. The logic circuit may be tested using steps a, b, and c below.

a. U4-8 = "0" when +5 Vdc = "1" and U3-6 = "1".

b. U5-8 = "1" when U4-8 = "0", P8-10 = "1", and U5-5 = "1".

c. U4-6 = "0" when U5-8 = "1", U4-4 = "1", and U4-5 = "1".

5-11. REPAIR.

5-12. Repair of the unit should be attempted only by an electronics technician or personnel experienced in printed wiring techniques. Recommended repair is limited to the replacement of defective components and adjustment of controls. When removing and replacing defective components, care should be exercised so as not to damage surrounding components or the circuit board. Replacement parts must be of the correct type and value, as listed in the parts list in Section VI. When installing a new part, place it in the exact position of the replaced part. After replacement, carefully inspect the circuit board for evidence of cold solder joints, solder splashes, solder flux, and insecurity of mounting. If the equipment is repaired, the amplifiers should be checked by recording and reproducing a reference signal. Refer to Section III of the system manual for the recording and reproducing procedures.

5-13. PARTS IDENTIFICATION. Components of the 12-471 Tape Lock Servo are illustrated and listed in Section VI. The parts list itemizes the component parts of the amplifier and provides the Bell & Howell part number for each component of the unit.

5-14. FIELD REPAIR SERVICE.

5-15. Refer to Section V of the system manual for field repair service information.

5-16. FACTORY REPAIR SERVICE.

5-17. Refer to Section V of the system manual for factory repair service information.

# SECTION VI

## PARTS LIST

6-1. GENERAL.

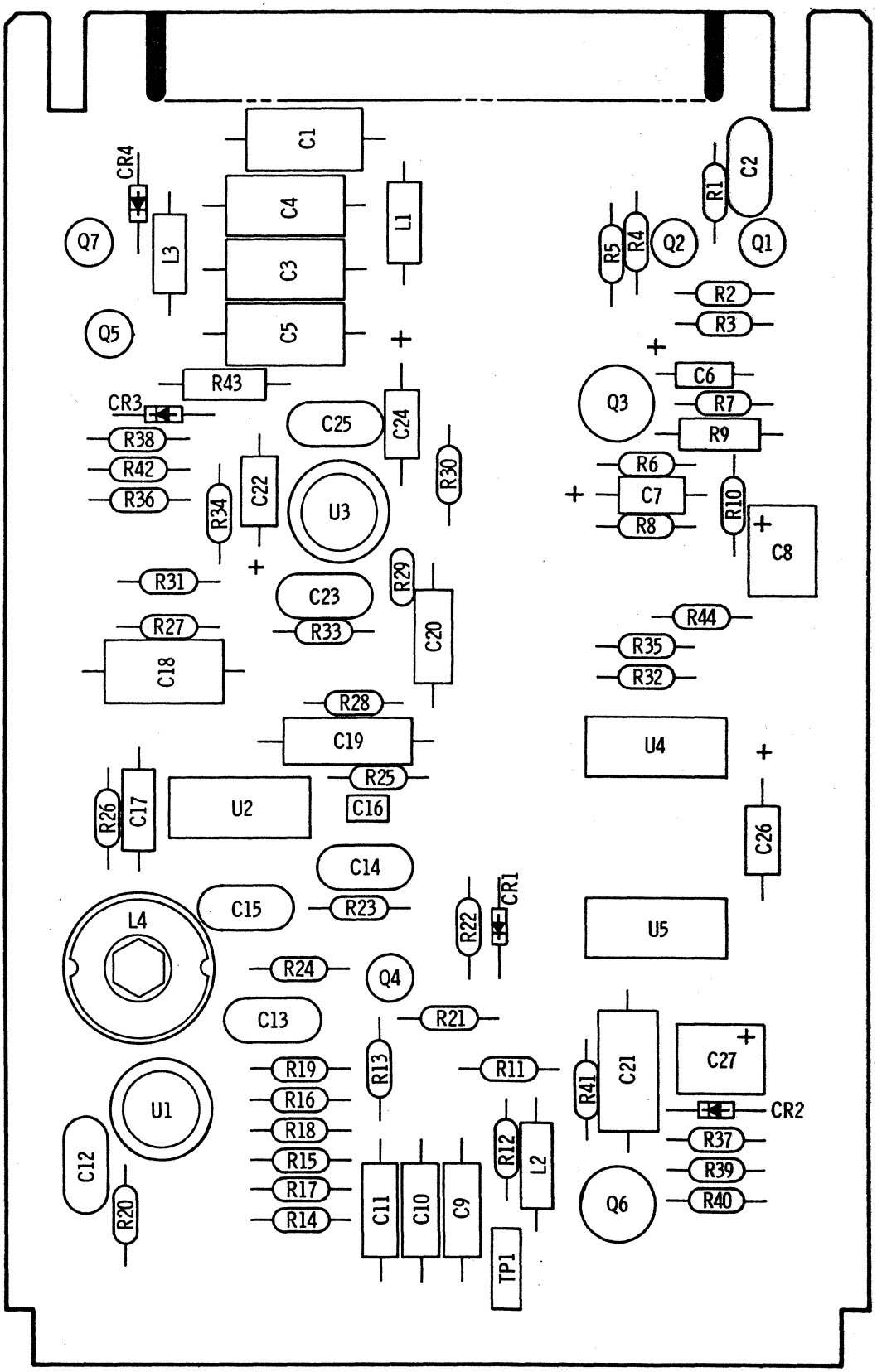
6-2. Appropriate parts lists and illustrations for the 12-471 Tape Lock Servo, Bell & Howell part number 476364, covered by this manual follow the instructions given below. The parts list (table 6-1) includes Bell & Howell DATATAPE Division part number, description, figure and index and/or schematic reference symbol, and where applicable, the manufacturer's or military part number for each component.

6-3. MANUFACTURER'S CODES.

6-4. Manufacturer's code symbols used in the parts list are tabulated in the System manual with the manufacturer's name and address. All code symbols are in accordance with the Federal Supply Code for Manufacturers Handbooks H 4-1 and H 4-2.

6-5. ORDERING REPLACEMENT PARTS.

6-6. When ordering replacement parts refer to Section VI of the System manual for ordering instructions.




D-476365-E (REF)



Figure 6-1. Tape Lock Servo Printed Wiring Board

Table 6-1. Parts List for the 12-471 Tape Lock Servo (Sheet 1 of 5)

| ITEM NO. | B&H PART NO. | DESCRIPTION 0 1 2 3 4 5 6 | QTY | FIG./INDEX OR REF SYM | MFR CODE | MFR OR MIL PART NO. |
|---|---|---|---|---|---|---|
| 1 | 476364 | Tape Servo | 1 | | | |
| 2 | 126716-0174 | Cable, rf, coaxial RG/174AU | A/R | | 23172 | QPL-17 |
| 3 | 155527-0001 | Ferrule, rf cable grounding violet | 2 | | 00779 | 323930 |
| 4 | 379495 | Plate, electrical shield | 1 | | | |
| 5 | 379656-0006 | Panel Assembly, front | 1 | | | |
| 6 | 479639 | Plate, connector mount | 2 | | | |
| 7 | 379494-0004 | Panel, front, amplifier module | 1 | | | |
| 8 | 379380-0007 | Label | 1 | | | |
| 9 | 376402-0003 | Lamp Assembly, panel | 1 | DS1 | 32539 | L-28/40 |
| 10 | 126732-0031 | Connector, coaxial | 2 | J1,2 | 91836 | KC-79-46 |
| 11 | 247234-0001 | Switch, toggle 1P2T on-none-on | 1 | S1 | 09353 | 7101 |
| 12 | 476365-0001 | Printed Wiring Board | 1 | 6-1 | | |
| 13 | 126716-0174 | Cable, rf, coaxial RG/174AU | A/R | | 23172 | QPL-17 |
| 14 | 155527-0001 | Ferrule, rf cable grounding violet | 4 | | 00779 | 323930 |
| 15 | 246954 | Diode, signal switching 25 V working voltage | 4 | CR1,2,3, CR4 | 03508 | 1N4154 |
| 16 | 215095-0492 | Cap, fixed, mylar 0.1 uF ±10%, 80 V | 6 | C1,3,4, C5,18 C21 | 56289 | 192P1049R8 |
| 17 | 215095-0592 | Cap, fixed, mylar 0.01 uF ±10%, 80 V | 3 | C10,11,20 | 56289 | 192P1039R8 |

Table 6-1. Parts List for the 12-471 Tape Lock Servo (Sheet 2 of 5)

| ITEM NO. | B&H PART NO. | DESCRIPTION 0 1 2 3 4 5 6 | QTY | FIG./INDEX OR REF SYM | MFR CODE | MFR OR MIL PART NO. |
|---|---|---|---|---|---|---|
| | | | | 6-1 | | |
| 1 | 70094-3045 | Cap, fixed, mica 500 pF ±10%, 500 Vdc | 2 | C12,23 | 93790 | CD15F501K03-500WV |
| 2 | 70094-3009 | Cap, fixed, mica 20 pF ±10%, 500 Vdc | 2 | C13,25 | 93790 | CD15E200K03-500WV |
| 3 | 70094-3040 | Cap, fixed, mica 330 pF ±10%, 500 Vdc | 1 | C14 | 93790 | CD15F331K03-500WV |
| 4 | 70094-3025 | Cap, fixed, mica 82 pF ±10%, 500 Vdc | 1 | C15 | 93790 | CD15E820K03-500WV |
| 5 | 479699-5086 | Cap, fixed, ceramic 6200 pF ±5%, 100 Vdc | 1 | C16 | 72982 | CK05BX622J |
| 6 | 215095-0162 | Cap, fixed, mylar 0.0015 uF ±10%, 200 V | 1 | C17 | 56289 | 192P15292 |
| 7 | 215095-0302 | Cap, fixed, mylar 0.022 uF ±10%, 200 V | 1 | C19 | 56289 | 192P22392 |
| 8 | 70094-3027 | Cap, fixed, mica 100 pF ±10%, 500 Vdc | 1 | C2 | 93790 | CD15F101K03-500WV |
| 9 | 471863-0006 | Cap, fixed, tantalum 2.2 uF ±20%, 25 Vdc | 1 | C6 | 31433 | T320A225-M25AS |
| 10 | 471863-0004 | Cap, fixed, tantalum 10.0 uF ±20%, 20 Vdc | 4 | C7,22, C24,26 | 31433 | T320B106-M20AS |
| 11 | 471920-0004 | Cap, fixed, tantalum 22 uF ±20%, 25 Vdc | 2 | C8,27 | 05397 | T362-C-226-M-025-AS |
| 12 | 215095-0192 | Cap, fixed, mylar 0.0027 uF ±10%, 200 V | 1 | C9 | 56289 | 192P27292 |
| 13 | 471788-0001 | Coil, radio frequency 10 uH ±10% | 2 | L1,3 | 99800 | 1537-36 |
| 14 | 472466-0046 | Inductor, fixed, shielded 1000 uH ±5% | 1 | L2 | 76493 | 9250-105-5PCT |
| 15 | 475697 | Inductor | 1 | L4 | | |

Table 6-1. Parts List for the 12-471 Tape Lock Servo (Sheet 3 of 5)

| ITEM NO. | B&H PART NO. | DESCRIPTION 0 1 2 3 4 5 6 | QTY | FIG./INDEX OR REF SYM | MFR CODE | MFR OR MIL PART NO. |
|---|---|---|---|---|---|---|
| | | | | 6-1 | | |
| 1 | 253082-0004 | Transistor, NPN 2N3904 | 4 | Q1,2,5,7 | 04713 | 2N3904 |
| 2 | 471927 | Transistor, NPN 2N2219 | 1 | Q3 | 04713 | 2N2219 |
| 3 | 471931 | Transistor, PNP hi freq switch | 1 | Q4 | 04713 | 2N3251 |
| 4 | 471925 | Transistor, PNP 2N2905 | 1 | Q6 | 04713 | 2N2905 |
| 5 | 471922-1032 | Res, fixed, metal oxide 10K ohm ±2%, 1/4 W | 8 | R1,5,7, R13,22, R30,36, R40 | 24546 | C4-10K OHM 2 PCT |
| 6 | 471922-5122 | Res, fixed, metal oxide 5100 ohm ±2%, 1/4 W | 2 | R11,31 | 24546 | C4-5.1K OHM 2 PCT |
| 7 | 471922-5112 | Res, fixed, metal oxide 510 ohm ±2%, 1/4 W | 1 | R12 | 24546 | C4-510 OHM 2 PCT |
| 8 | 471922-2042 | Res, fixed, metal oxide 200K ohm ±2%, 1/4 W | 2 | R14,34 | 24546 | C4-0.20 MEG OHM 2 PCT |
| 9 | 471922-3332 | Res, fixed, metal oxide 33K ohm ±2%, 1/4 W | 2 | R15,24 | 24546 | C4-33K OHM 2 PCT |
| 10 | 471922-3032 | Res, fixed, metal oxide 30K ohm ±2%, 1/4 W | 3 | R16,18, R37 | 24546 | C4-30K OHM 2 PCT |
| 11 | 471922-3042 | Res, fixed, metal oxide 300K ohm ±2%, 1/4 W | 2 | R17,19 | 24546 | C4-300K OHM 2 PCT |
| 12 | 471922-1022 | Res, fixed, metal oxide 1000 ohm ±2%, 1/4 W | 6 | R2,3,32, R35,41, R42 | 24546 | C4-1K OHM 2 PCT |
| 13 | 471922-1522 | Res fixed, metal oxide 1500 ohm ±2%, 1/4 W | 3 | R20,28, R33 | 24546 | C4-1500 OHM 2 PCT |

Table 6-1. Parts List for the 12-471 Tape Lock Servo (Sheet 4 of 5)

| ITEM NO. | B&H PART NO. | DESCRIPTION 0 1 2 3 4 5 6 | QTY | FIG./INDEX OR REF SYM | MFR CODE | MFR OR MIL PART NO. |
|---|---|---|---|---|---|---|
| | | | | 6-1 | | |
| 1 | 471922-1332 | Res, fixed, metal oxide 13K ohm ±2%, 1/4 W | 1 | R23 | 24546 | C4-13K OHM 2 PCT |
| 2 | 471922-3022 | Res, fixed, metal oxide 3K ohm ±2%, 1/4 W | 1 | R25 | 24546 | C4-3000 OHM 2 PCT |
| 3 | 471922-6222 | Res, fixed, metal oxide 6200 ohm ±2%, 1/4 W | 1 | R26 | 24546 | C4-6200 OHM 2 PCT |
| 4 | 471922-7512 | Res, fixed, metal oxide 750 ohm ±2%, 1/4 W | 1 | R27 | 24546 | C4-750 OHM 2 PCT |
| 5 | 471922-1042 | Res, fixed, metal oxide 100K ohm ±2%, 1/4 W | 1 | R29 | 24546 | C4-100K OHM 2 PCT |
| 6 | 471922-5132 | Res, fixed, metal oxide 51K ohm ±2%, 1/4 W | 1 | R38 | 24546 | C4-51K OHM 2 PCT |
| 7 | 471922-6802 | Res, fixed, metal oxide 68 ohm ±2%, 1/4 W | 1 | R39 | 24546 | C4-68 OHM 2 PCT |
| 8 | 471922-2032 | Res, fixed, metal oxide 20K ohm ±2%, 1/4 W | 2 | R4,21 | 24546 | C4-20K OHM 2 PCT |
| 9 | 7138-1025 | Res, fixed, composition 1000 ohm ±5%, 1/2 W | 1 | R43 | | RCR20G102JS |
| 10 | 471922-1512 | Res, fixed, metal oxide 150 ohm ±2%, 1/4 W | 1 | R44 | 24546 | C4-150 OHM 2 PCT |
| 11 | 471922-4722 | Res, fixed, metal oxide 4.7K ohm ±2%, 1/4 W | 1 | R6 | 24546 | C4-4.7K OHM 2 PCT |
| 12 | 471922-1002 | Res, fixed, metal oxide 10 ohm ±2%, 1/4 W | 2 | R8,10 | 24546 | C4-10 OHM 2 PCT |
| 13 | 7138-4715 | Res, fixed, composition 470 ohm ±5%, 1/2 W | 1 | R9 | | RCR20G471JS |
| 14 | 204749-1008 | Jack, tip, horizontal, pc brown | 1 | TP1 | 83330 | 430-108 |

Table 6-1. Parts List for the 12-471 Tape Lock Servo (Sheet 5 of 5)

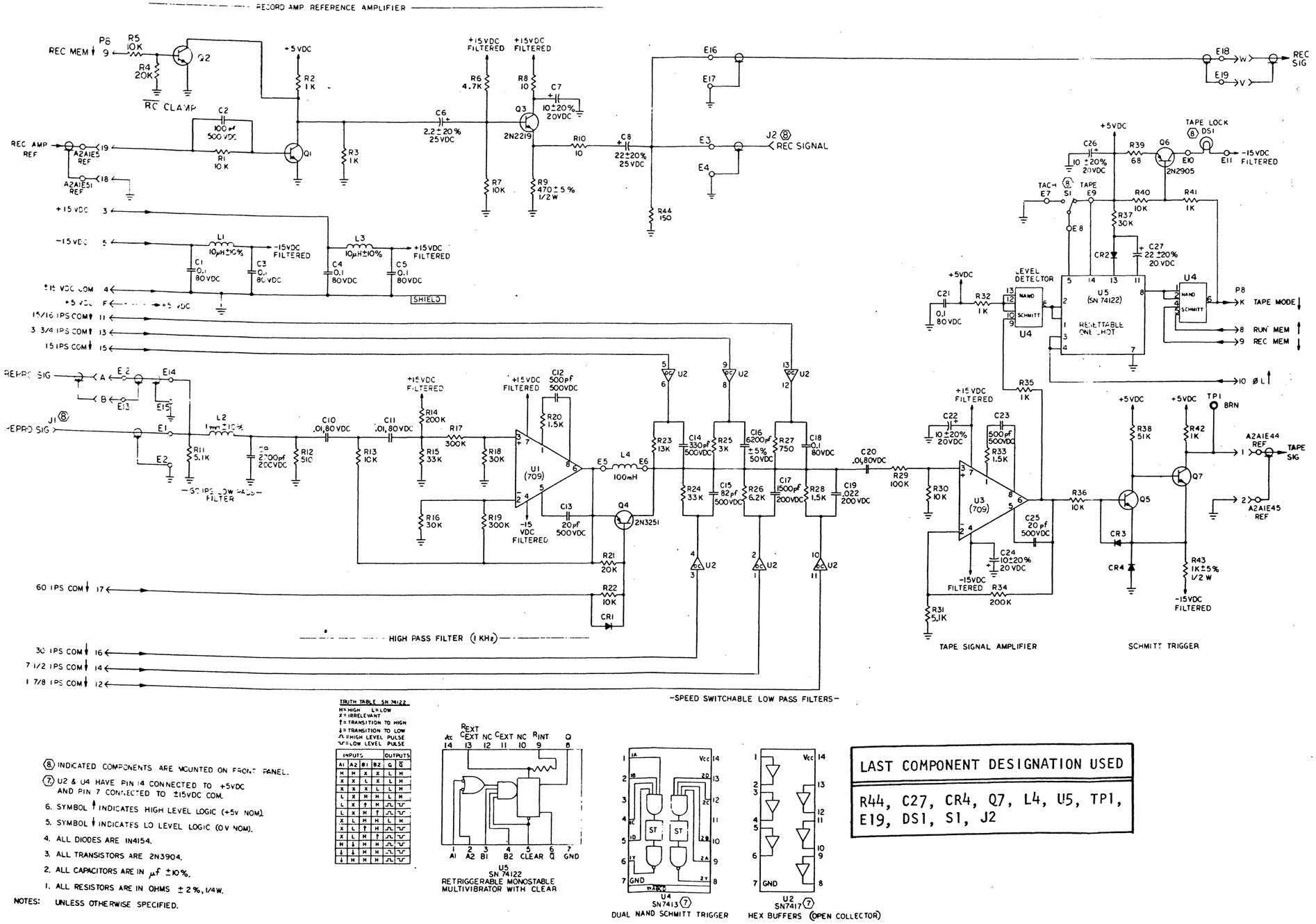
| ITEM NO. | B&H PART NO. | DESCRIPTION 0 1 2 3 4 5 6 | QTY | FIG./INDEX OR REF SYM | MFR CODE | MFR OR MIL PART NO. |
|---|---|---|---|---|---|---|
| | | | | 6-1 | | |
| 1 | 360742-0001 | Integrated Circuit operational amplifier | 2 | U1,3 | 07263 | UA709HC |
| 2 | 475695 | Integrated Circuit 7417 hex buf/driv-open cl | 1 | U2 | 01295 | SN7417N,J |
| 3 | 475677 | Integrated Circuit 7413 dual 4-inp Schmitt | 1 | U4 | 01295 | S7413N,J |
| 4 | 475691 | Integrated Circuit 74122 mono multivibrator | 1 | U5 | 01295 | SN74122N |

# SECTION VII

# SCHEMATICS

7-1. GENERAL.

7-2. This section contains the schematic diagram (figure 7-1) for the 12-471 Tape Lock Servo.




TRUTH TABLE SN 74122
H = HIGH L = LOW
X = IRRELEVANT
↑ = TRANSITION TO HIGH
↓ = TRANSITION TO LOW
⊓ = HIGH LEVEL PULSE
⊔ = LOW LEVEL PULSE

| INPUTS | | | | OUTPUTS | |
|---|---|---|---|---|---|
| A1 | A2 | B1 | B2 | Q | $\bar{Q}$ |
| H | H | X | X | L | H |
| X | X | L | X | L | H |
| X | X | X | L | L | H |
| L | X | H | H | L | H |
| L | X | ↑ | H | ⊓ | ⊔ |
| L | X | H | ↑ | ⊓ | ⊔ |
| X | L | H | H | L | H |
| X | L | ↑ | H | ⊓ | ⊔ |
| X | L | H | ↑ | ⊓ | ⊔ |
| H | ↓ | H | H | ⊔ | ⊓ |
| ↓ | ↓ | H | H | ⊔ | ⊓ |
| ↓ | H | H | H | ⊔ | ⊓ |

U5
SN 74122
RETRIGGERABLE MONOSTABLE MULTIVIBRATOR WITH CLEAR

U4
SN7413 (7)
DUAL NAND SCHMITT TRIGGER

U2
SN7417 (7)
HEX BUFFERS (OPEN COLLECTOR)

(8) INDICATED COMPONENTS ARE MOUNTED ON FRONT PANEL.

(7) U2 & U4 HAVE PIN 14 CONNECTED TO +5VDC AND PIN 7 CONNECTED TO ±15VDC COM.

6. SYMBOL ↑ INDICATES HIGH LEVEL LOGIC (+5V NOM).

5. SYMBOL ↓ INDICATES LO LEVEL LOGIC (0V NOM).

4. ALL DIODES ARE IN4154.

3. ALL TRANSISTORS ARE 2N3904.

2. ALL CAPACITORS ARE IN μf ±10%.

1. ALL RESISTORS ARE IN OHMS ± 2%, 1/4W.

NOTES: UNLESS OTHERWISE SPECIFIED.

| LAST COMPONENT DESIGNATION USED |
|---|
| R44, C27, CR4, Q7, L4, U5, TP1, E19, DS1, S1, J2 |

E-476366-D(REF)

Figure 7-1. Schematic, Tape Lock Servo